

WHAT IS CLAIMED IS:

1. A process for recycling carbon dioxide emissions from a fossil-fuel power plant into carbonated species, comprising the steps of:
 - a) combustion of a fossil fuel, thereby generating heat and a hot exhaust gas containing CO₂;
 - b) converting said heat into energy;the process being characterized in that it comprises the steps of:
 - c) cooling said exhaust gas; and
 - d) reducing the amount of CO₂ contained in the cooled exhaust gas by biologically transforming said CO₂ into carbonated species; thereby obtaining a low CO₂ exhaust gas.
2. A process as defined in claim 1, characterized in that step d) comprises the steps of:
 - catalyzing the hydration of at least a portion of the CO₂ contained in the exhaust gas and producing a solution containing hydrogen ions and carbonate ions; and
 - adding to said solution metal ions, and adjusting the pH of the solution to precipitate a carbonate of said metal;wherein said hydration is catalyzed by a biocatalyst capable of catalyzing the hydration of dissolved CO₂ into hydrogen ions and bicarbonate ions.
3. A process as defined in claim 2, characterized in that said biocatalyst is selected from the group consisting of enzyme, cellular organelle, mammal cells and vegetal cells.
4. A process as defined in claim 3, characterized in that the biocatalyst is the enzyme carbonic anhydrase or an analogue thereof.
5. A process as defined in claim 2, wherein step d) comprises the step of:
 - feeding liquid H₂O and at least a portion of the exhaust gas into a bioreactor containing therein a reaction chamber filled with said biocatalyst.

6. A process as defined in claim 5, characterized in that the biocatalyst is immobilized on solid supports packing the bioreactor.
7. A process as defined in claim 2, wherein step d) comprises the step of:
- feeding at least a portion of the exhaust gas into a bioreactor
- 5 containing therein a reaction chamber filled with said biocatalyst in suspension in a liquid phase.
8. A process as defined in claim 7, characterized in that the biocatalyst is free in said aqueous liquid phase, or immobilized on solid supports or entrapped inside a solid matrix.
- 10 9. A process as defined in any one of claims 2 to 8, characterized in that, in step c), the exhaust gas is cooled to a temperature sufficiently low so as to maintain a catalytic effect of the biocatalyst.
10. A process as defined in any one of claims 1 to 9, characterized in that it comprises, prior to step d) of reducing, the step of:
- 15 - removing from the exhaust gas additional contaminants contained in the exhaust gas.
11. A process as defined in claim 10, characterized in that said additional contaminants are selected from the group consisting of ash, NO_x and SO₂.
12. A process as claimed in claim 2, characterized in that the metal ions
- 20 are selected from the group consisting of calcium, barium, magnesium and sodium ions.
13. A process as defined in claim 12, characterized in that said metal ions are Ca⁺⁺ and the carbonate is CaCO₃.
14. A process as defined in any one of claims 1 to 13, characterized in that
- 25 step c) of cooling is performed by means of a heat exchanger that removes heat from said cooled exhaust gas, the heat removed being recycled in step b) of the process.

15. A power plant for producing energy from fossil fuel, and recycling carbon dioxide emissions into carbonated species, the plant comprising:

- a combustion unit for burning fossil fuel, thereby producing heat and an exhaust gas containing CO₂;

5 - means for converting said heat into energy;

the plant being characterized in that it comprises:

- means for cooling the exhaust gas;

- biological means for biologically transforming at least a portion of the CO₂ from the cooled exhaust gas into hydrogen ions and carbonate

10 ions; and

- precipitation means for precipitating carbonated species from the carbonate ions.

16. A power plant as defined in claim 15, characterized in that said means for cooling the exhaust gas comprises a heat exchanger.

15 17. A power plant as defined in claim 15, characterized in that said biological means comprises a bioreactor including a reaction chamber filled with a biocatalyst capable of catalyzing the hydration of dissolved CO₂ into hydrogen ions and bicarbonate ions.

20 18. A power plant as defined in claim 17, characterized in that the reaction chamber comprises:

- a liquid inlet for receiving an aqueous liquid;

- a gas inlet for receiving the cooled exhaust gas to be treated;

- a gas outlet for releasing a low CO₂ gas; and

25 - a liquid outlet for releasing a solution containing carbonate ions.

19. A power plant as defined in claim 18, characterized in that the precipitating means comprises:

- a precipitation vessel to react said bicarbonate ions with metal ions and precipitate a carbonate of said metal.

20. A power plant as defined in claim 18, characterized in that the biocatalyst is immobilized on solid supports packing the reaction chamber.

5 21. A power plant as defined in claim 18, characterized in that the biocatalyst is in suspension in an aqueous phase filling the reaction chamber.

22. A power plant as defined in claim 21, characterized in that the biocatalyst is free in said liquid phase, immobilized on solid supports or
10 entrapped inside a solid matrix.